CARTRIDGE DEVICE FOR BLOOD ANALYSIS

CLAIMS

1. Cartridge device (20) for analysing blood comprising:

a cell (9) having a receiving portion (10) for receiving a blood sample and a plug or jack portion (18) for receiving a plug or a jack (22);

means (19) for circulating said blood sample within said receiving portion (10); and

an electrode holder (14) having at least one incorporated electrode pair (16; 24; 25; 26);

wherein the electrode holder (14) is attachable to the cell (9) such that one end (16a; 24a; 25a; 26a) of the at least one electrode pair (16; 24; 25; 26) forms a sensor unit (17a; 17b; 17c; 17d) for measuring the electrical impedance between the two electrodes of the at least one electrode pair (16; 24; 25; 26) within the blood sample and that the opposite end (16b; 24b; 25b; 26b) of the at least one electrode pair (16; 24; 25; 26) forms a plug or jack portion (21a; 21b; 21c; 21d) being connectable directly to the plug or the jack (22) for an electrical connection of the sensor unit (17a; 17b; 17c; 17d) to an analyser.

2. Cartridge device (20) according to claim 1, characterised in that the cell (9) is made as a one-piece cell by injection moulding.

3. Cartridge device (20) according to claim 1 or 2, characterised in that the receiving portion (10) has a cylindrical shape with one open face side.

4. Cartridge device (20) according to at least one of the preceding claims, characterised in that a at least partly conical formed funnel tube (11) is connected to the open face side of the receiving portion (10) for filling in the blood sample.

5. Cartridge device (20) according to claim 4, characterised in that two guiding rails (13) are positioned on the inner surface of the funnel tube (11) for guiding the electrode holder (14) into position.

6. Cartridge device (20) according to claim 4 or 5, characterised in that a stopping wall (27) is positioned between the funnel tube (11) and the jack portion (12) for positioning the electrode holder (14) into a stable position.

7. Cartridge device (20) according to at least one of the preceding claims, characterised in that the cell (9) is made of a blood compatible material, such as polystyrene, polymethyl methacrylate (PMMA), polyethylene etc.

8. Cartridge device (20) according to at least one of the preceding claims, characterised in that the electrode

holder (14) comprises a plastic body (15) which is made by injection moulding.

9. Cartridge device (20) according to claim 8, characterised in that the plastic body (15) of the electrode holder (14) has a thickness of about 1 to 5 mm.

10. Cartridge device (20) according to at least one of the preceding claims, characterised in that the electrode holder (14) is made of a blood compatible material such as polystyrene, polymethyl methacrylate (PMMA), polyethylene, etc.

11. Cartridge device (20) according to at least one of the preceding claims, characterised in that the electrode holder (14) comprises a L-formed body (15) with a long part (15a) and a short part (15b) perpendicular to the long part (15a)

12. Cartridge device (20) according to at least one of the preceding claims, characterised in that two electrode pairs (16, 24) are symmetrically incorporated in the electrode holder (14) for two independent separate measurement results.

13. Cartridge device (20) according to at least one of the claims 1 to 11, characterised in that three electrode pairs (16, 24, 25) are linear incorporated in the electrode holder (14) for three separate measurement results, wherein one electrode pair (24) is preferably positioned in the middle of the remaining electrode

pairs (16, 25) for comparing platelet adhesion and aggregation under varying flow conditions.

14. Cartridge device (20) according to at least one of the claims 1 to 11, characterised in that four electrode pairs (16, 24, 25, 26) are linear incorporated in the electrode holder (24) for four separate measurement results for making a double-determination of the platelet aggregation under low and high blood flow conditions.

15. Cartridge device (20) according to at least one of the claims 1 to 11, characterised in that at least three electrode pairs (16, 24, 25) are arranged symmetrically to each other at the same radial position in the receiving portion (10).

16. Cartridge device (20) according to at least one of the preceding claims, characterised in that the two electrodes of one electrode pair (16, 24, 25, 26) are positioned parallel to each other and spaced apart from each other.

17. Cartridge device (20) according to at least one of the preceding claims, characterised in that two electrode pairs (16, 24, 25, 26) are positioned parallel to each other and spaced apart from each other.

18. Cartridge device (20) according to at least one of the preceding claims, characterised in that the electrodes are formed as wires made of a first material compris-

ing a high conductivity, which is covered by a second material comprising a high electrical conductivity and being resistant against oxidation.

19. Cartridge device (20) according to claim 18, characterised in that the first material is copper, copper alloy, such as copper-silver alloy, copper-magnesium alloy or such like, preferably a silver-copper alloy comprising 0,2 to 2 % silver, most preferably 0,9 % silver.

20. Cartridge device (20) according to claim 18 or 19, characterised in that the second material is a precious metal such as silver, platin, gold or such like.

21. Cartridge device (20) according to claim 20, characterised in that the second precious metal is a silver coating in the range of about 0,5 to 20 g/kg, most preferably 2 g/kg.

22. Cartridge device (20) according to at least one of the preceding claims, characterised in that the electrode wires have a diameter of about 0,1 to 0,5 mm, preferably 0,3 mm.

23. Cartridge device (20) according to at least one of the preceding claims, characterised in that the means (19) are a stir bar (19), which is made of steel, siliconized steel, Teflon or Teflon-coated, preferably siliconized stainless steel, wherein the stir bar (19) is for example actuated by permanent magnets.

24. Cartridge device (20) according to at least one of the preceding claims, characterised in that the plug (22) is a standard RJ12 plug.

25. Cartridge device for analysing blood comprising:

a cell having a receiving portion for receiving a blood sample;

a stirring device for circulating said blood sample within said receiving portion; and

at least two electrodes for measuring the electrical impedance between the at least two electrodes within the blood sample;

wherein the at least two electrodes consist of a metal comprising a first material with a high electrical conductivity, which is covered by a second material, which has a high electrical conductivity and which is resistant against oxidation.

26. Cartridge device according to claim 25, characterised in that the first material is copper, copper alloy, such as copper-silver alloy, copper-magnesium alloy or such like, preferably a silver-copper alloy comprising 0,2 to 2 % silver, most preferably 0,9 % silver.

27. Cartridge device according to claim 25 or 26, characterised in that the second material is a precious metal such as silver, platin, gold or such like.

28. Cartridge device according to claim 27, characterised in that the second precious metal is a silver coating in the range of about 0,5 to 20 g/kg, most preferably 2 g/kg.

29. A method for analysing blood by means of a cartridge device comprising at least three electrode wires or electrodes for measuring the electrical impedance between at least two of the at least three electrode wires or electrodes, comprising the following steps:

measuring the electrical impedance between at least two different pairs of electrode wires or electrodes;

comparing the measured electrical impedance values;

discarding and repeating the measurements in case the variation is outside a predetermined threshold range; or

indicating the measured electrical impedance values and/or the mean or median value thereof in case the variation is within the predetermined threshold range.

30. Method according to claim 29, characterised in that only those measurement values are rejected, which are outside a predetermined threshold range, wherein the remaining measurement values and/or the mean values thereof are indicated.